数学与系统科学研究院

计算数学所学术报告

报告人： **Dr. Melvin Leok**

(Department of Mathematics, Purdue University)

报告题目：

Lie group and homogeneous variational integrators and their applications to geometric optimal control theory

邀请人： 洪佳林研究员

报告时间： **2008年6月16日(周一)**

下午14:00—15:00

报告地点： **科技综合楼三层311**

计算数学所报告厅

Abstract：

The geometric approach to mechanics serves as the theoretical underpinning of innovative control methodologies in geometric control theory. These techniques allow the attitude of satellites to be controlled using changes in its shape, as opposed to chemical propulsion, and are the basis for understanding the ability of a falling cat to always land on its feet, even when released in an inverted orientation.
We will discuss the application of geometric structure-preserving numerical schemes to the optimal control of mechanical systems. In particular, we consider Lie group variational integrators, which are based on a discretization of Hamilton's principle that preserves the Lie group structure of the configuration space. In contrast to traditional Lie group integrators, issues of equivariance and order- of-accuracy are independent of the choice of retraction in the variational formulation. The importance of simultaneously preserving the symplectic and Lie group properties is also demonstrated. In addition, we will introduce a

numerically robust shooting based optimization algorithm that relies on the conservation properties of geometric integrators to accurately compute sensitivity derivatives, thereby yielding an optimization algorithm for the control of mechanical systems that is exceptionally efficient. The role of geometric phases in these control algorithms will also be addressed. Recent extensions to homogeneous spaces yield intrinsic methods for Hamiltonian flows on the sphere, and have potential applications to the simulation of geometric exact rods, structures and mechanisms. We will place recent work in the context of progress towards a coherent theory of computational geometric mechanics and computational geometric control theory, which is concerned with developing a self-consistent discrete theory of differential geometry, mechanics, and control.

欢迎大家参加！